language by comparing their positions with those we observe in the spectra of terrestrial light sources.

But a straight slit is not the only kind of aperture we can employ; we may replace it by a ring, for instance.

What we shall see in passing from the spectrum of a candle to the spectrum of a spirit-lamp flame with salt in it, using first a straight and then a circular slit, is shown in the accompanying woodcut (Fig. 4).

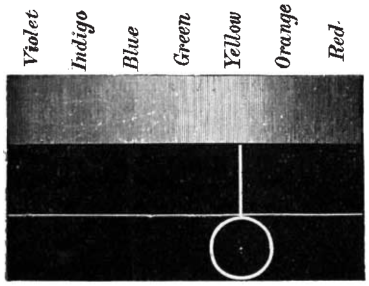

FIG. 4.—The spectra of continuous and discontinuous light sources, the latter seen with a line and circular slit.

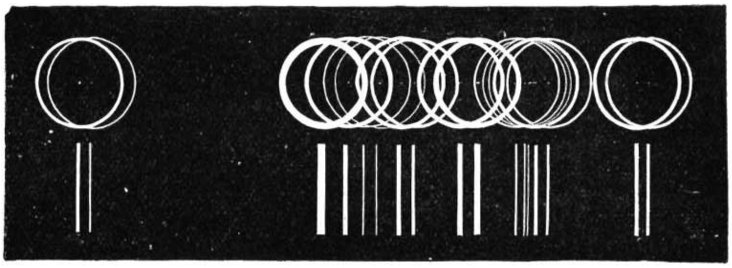

FIG. 5.—The spectrum of a complicated light-source as seen with a circular and a line slit.

If we examine a very complicated light source we shall arrive at the same result, a spectrum characterised by a large number of bright circles or lines (Fig. 5).

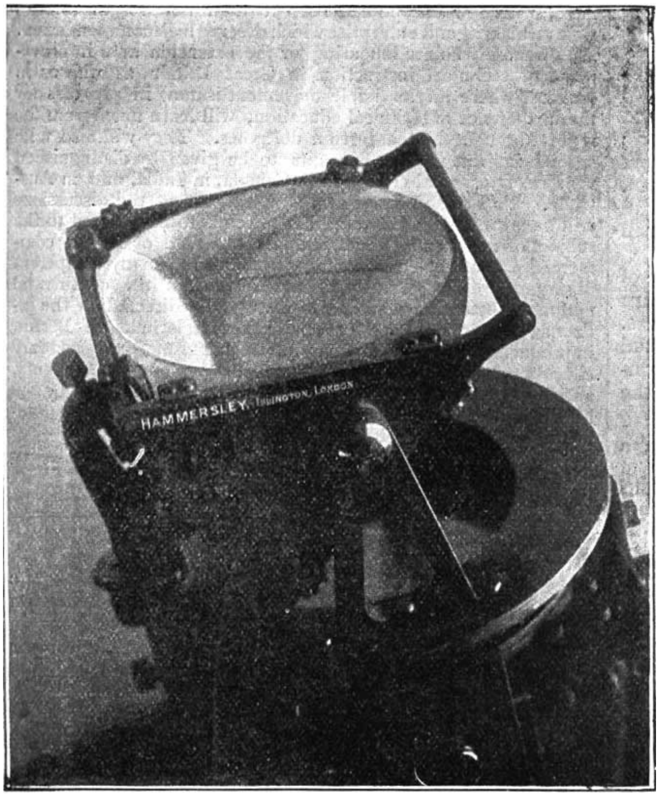

FIG. 6.—Details of objective prism.

We have seen that in an ordinary spectroscope, when we are studying light sources close to us, the rays have to be made parallel before they pass through the prism. But the heavenly bodies are at such a distance from us that their light reaches us in a parallel beam, so that one part of the spectroscope, the collimator, may be dispensed with. A star as a point is part of a line slit; hence the success of Fraunhofer's arrangement for observing stellar spectra, to which I have referred. In an eclipse we get a bright narrow ring round the dark moon. There is our ring slit. Hence the so-called "slitless spectroscope," or "prismatic camera," as it is called when photography is employed, used to study the spectra of stars and the sun's chromosphere during eclipses.

The way in which, in the prismatic camera, the prism is fixed outside the object-glass, is shown in the accompanying figure (Fig. 6).

We are now in a position to inquire how this arrangement has been used during eclipses since 1871.

J. NORMAN LOCKYER.

(*To be continued.*)

THE OLD RED SANDSTONE OF LORNE.

THE terraced hills of Lorne, though a familiar feature in the scenery of western Argyllshire, have not yet had their geology properly worked out. Their peculiar topography, however, has long been known to arise from the outcrops of successive sheets of lava, lying upon and intercalated with strata of purple shale and conglomerate. The age of these strata has never been satisfactorily settled. For many years past I have regarded them as probably belonging to the Lower Old Red Sandstone, for their lithological characters present a close resemblance to those of the great basin of that age in central Scotland, which I have distinguished by the name of "Lake Caledonia." While recently mapping in the district, Mr. R. G. Symes, of the Geological Survey, came upon an exposure of the sedimentary rocks, which seemed to him so promising a locality for fossils that he requested the assistance of one of the fossil-collectors of the staff with a view to more minute examination. Accordingly, Mr. A. Macconochie was detailed for the purpose, and was soon rewarded by the discovery of undoubted remains of plants and fishes. The specimens were first sent to the Office of the Survey in Edinburgh, where the plants were recognised by Mr. B. N. Peach as portions of *Psilophyton*, and the fish-remains as parts of *Cephalaspis*. His identification of the ichthyolites was immediately confirmed by Dr. R. H. Traquair. The specimens were then forwarded to the Jermyn Street Museum, where they have been again examined by Mr. E. T. Newton, who entirely agrees with the opinion already pronounced regarding them.

The occurrence of a genus of plants and another of fishes so characteristic of the Lower Old Red Sandstone

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of central Scotland is of singular interest and importance, for it definitely fixes the geological age of the volcanic series of western Argyllshire and its accompanying sedimentary deposits. ARCH. GEIKIE.

INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION.

THE International Congress on Technical Education, referred to in last week's NATURE, was opened on Tuesday, at the rooms of the Society of Arts, under the presidency of the Duke of Devonshire. The meeting of the Congress in London is due to this Society, and to the City Companies, which guaranteed the necessary expenditure.

The subject of higher technical education claims the attention of all who are concerned with the progress of science and the development of arts and industries. The pressing importance of the question is indicated by the article which appears in another part of this number. We take it that the scheme of Prof. Klein, to establish an educational system which will bring theory and practice more closely together, is the ideal organisation. The man of science and the engineer should be one; for both need to understand the practical aspects of nature, and both are constantly inventing methods of investigation. Prof. Klein wishes to give life to fossilised Universities, and lead them "so to develop science that the results will be practically useful, and repay the debt to engineers which science now owes them." This aim, coming from one who has enriched mathematics with so many remarkable contributions, should do much to break down the supposed barrier between the investigator working in his laboratory and the engineer working towards the mastery of nature on a larger scale. For the details of the scheme, we refer our readers to the article in another place. To our mind, the plan proposed will do much to advance higher technical education; and it will perhaps lead to the development of teachers who are good mathematicians as well as practical men. In all countries there are signs of increasing interest in methods of education, so that Prof. Klein's views will doubtless receive consideration outside Germany.

In opening the International Congress, the Duke of Devonshire pointed out that each country could learn much from the experience and organisation of others. It is for this reason that such Congresses have a beneficial effect. In the course of his address, the Duke of Devonshire is also reported by the *Times* to have made the following remarks:—

> It is in a double capacity that I have the honour of offering a welcome to the International Congress on Technical Education. We have in this country a Department of Education, but its functions are almost entirely limited to elementary education, and we have not in our Administration any Minister who properly corresponds to the Minister of Education of other Governments. Nevertheless, the President of the Council is the Minister on whom the nearest approach to responsibility for education rests, and the Vice-President, Sir John Gorst—who, I trust, will take part in the future proceedings of the congress—is the Minister who, representing the Government on educational matters in the House of Commons, shares with the President a large part of his responsibility. It is, therefore, partly in our official capacity that Sir John Gorst and I take part in these proceedings. The comparatively unorganised condition of education as a whole has led to the formation of unofficial and irresponsible associations to promote and help to organise special branches of education to meet the growing needs of the country. Turning to the business of the congress, its previous assemblies have done much to increase public interest in the very important question of technical instruction; and the well-arranged and representative programme of the present assembly justifies the hope that its deliberations on the present occasion will be no less fruitful than in the past. The present time is well chosen for an international congress on technical instruction. In all countries there are signs of increasing interest in foreign methods of education. Systems of education, indeed, cannot be transferred ready-made from one country to another. Education is a thing too closely interwoven with national life and habits to permit any such easy transference. But when every allowance has been made for this it remains true that each country can learn very much from the experience and the educational organisation of other countries. Educational ideas and ideals may be communicated, although systems of administration cannot be transferred without great modification and adjustment to special circumstances; we find therefore that in point of fact English education has been materially affected during the last sixty years by waves of foreign influence coming in succession from France, Holland, Germany, Switzerland, America, and Scandinavia. And in some respects there is no department of education in which methods of teaching and plans of organisation can be more readily transferred from one country to another than is the case in technical instruction, which is the subject of the present congress. In many respects this country has been the debtor in this long process of foreign educational exchange. But there is one point at least in which continental critics are now paying Great Britain the compliment of careful study and even of admiration. The need for individual initiative and for freedom of local experiment has always been fully recognised in English education, and in no grade of it has this been more the case than in technical instruction. While the central Government, through its administrative departments, has not failed to give a certain measure of guidance to the new movement, it has thrown the greater part of the responsibility on the local authorities, believing that (in technical education especially) there must be great elasticity in administration and incessant adaptation of the means and form of instruction to meet the great variety of the industrial and commercial needs which exist in the different localities, but can only be ascertained and fully tested by local experiment. The local authorities have, with few exceptions, risen to their new responsibilities with an alacrity and enterprise which deserve high commendation. All of those who are labouring for the extension and improvement of technical instruction in Great Britain, as well as in Ireland, where a remarkable movement is now in progress for the furtherance of technical education, will learn much from the reports brought by the foreign delegates. They will also take special interest in the accounts to be given by distinguished visitors of technical education in Canada, in India, and in Australia. To British hearers probably no part of the discussions will be more instructive than that which is to be devoted to the subject of commercial education. In the field of higher commercial education, Great Britain is believed by many competent observers to be seriously behind several of the continental nations. Attention would also be usefully directed to the influence of Germany, and especially the Realschulen of Berlin, in producing, by means of a carefully planned modern secondary education, given by trained teachers of the highest attainments, an increasing number of youths eminently fitted to profit by the highest kinds of technical education, and to promote the commercial interests of their country.

Papers chiefly relating to different aspects of the teaching of chemistry were then read and discussed.

ALVAN G. CLARK.

A NOTE of extreme sadness is mingled with the congratulations that have followed the completion of the Yerkes telescope. Hardly is the object-glass in its cell, and before the final adjustments can possibly be complete, the intelligence comes that the artist, who has laboured so earnestly and so successfully in the work of figuring object-glasses of the largest size, is struck down suddenly by apoplexy. Ten years ago, Alvan Clark, the founder of the firm, died, after completing the lens of the Lick telescope, but before he could witness its complete installation and be assured of its final success. The son, Alvan G. Clark, was probably aware of the excellence of the Yerkes telescope, both from his own experience and the certificate of Prof. Keeler; but he, too, is denied the pleasure of seeing it used under the most favourable conditions, and of hearing expressed the full satisfaction of those astronomers in whose hands the telescope is placed.

It is impossible to disconnect the life of Alvan G.

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